Repeatability Evaluation of Direct-Write Printing on Flexible and Three-Dimensional Geometries

Completed Technology Project (2017 - 2018)

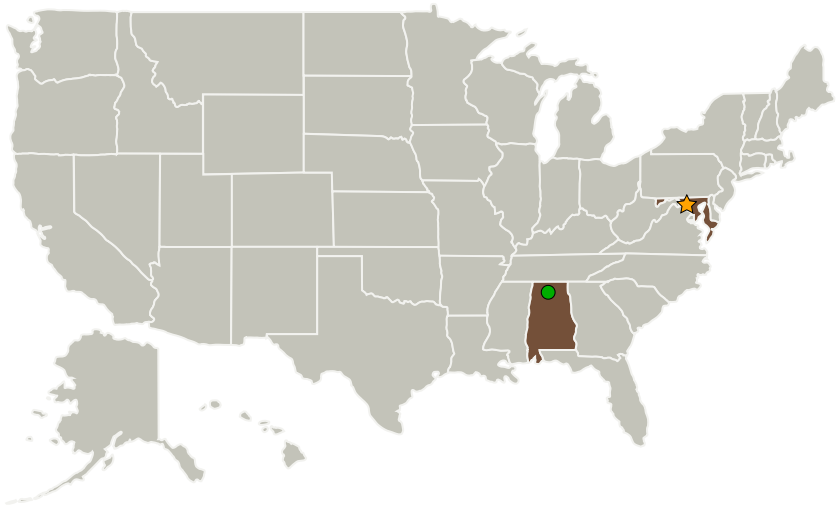
Project Introduction

This restart and expansion of the FY17 effort seeks to refine the team's capability to 3D print a variety of sensors, wire connectors, and related devices at micron scale. Pervious efforts demonstrated feasibility, but the techniques still require significant refinement in order to demonstrate repeatability. For FY18 the focus will be on validating the survivability of printed flexible readout strips during assembly and testing, and printing conformal conductive (and superconductive) traces over large-area assemblies and three-dimensional shapes. This effort supports such flight programs as PRAXyS and the Next Generation of X-ray Polarimeter (NGXP). For example, the current SAO for the NGXT detector is at a pitch of 121 micron. This direct write technology should reduce the pitch to 60 micros, thus increasing sensitivity by 3X. The FY18 effort will also investigate printing of Al superconducting inks. A key goal is 3D printing of the sensor assemblies by the end of the FY.

Anticipated Benefits

This project seeks to focus on the need for more dense and compact electronic and detector assemblies. This is addressed through the application of direct-wrtite additive manufacturing of electronic circuitry. As this is a new technology, development of reliable processes which insure repeatable results in fabrication is a significant issue, which is addressed via this CIF.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Georgia Institute of Technology-Main Campus(GA Tech)	Supporting Organization	Academia	Atlanta, Georgia
Laboratory for Physical Sciences	Supporting Organization	Industry	
●Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
NanoDirect LLC	Supporting Organization	Industry	Baltimore, Maryland
National Institute of Standards and Technology(NIST)	Supporting Organization	US Government	Boulder, Colorado
Optomec Inc	Supporting Organization	Industry	Albuquerque, New Mexico
Quest Integrated, LLC	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Kent, Washington
Raytheon Company	Supporting Organization	Industry	
Sun Chemical	Supporting Organization	Industry	New Jersey

Continued on following page.

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

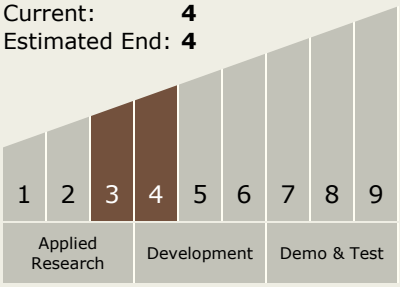
Peter M Hughes

Principal Investigator:

Beth M Paquette

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2017 - 2018)

Organizations Performing Work	Role	Type	Location
United Technologies Research Center	Supporting Organization	Industry	
University of Delaware	Supporting Organization	Academia	Newark, Delaware
University of Massachusetts-Lowell	Supporting Organization	Academia	Lowell, Massachusetts

Primary U.S. Work Locations	
Alabama	Maryland

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.2 Intelligent Integrated Manufacturing

Target Destinations

The Moon, Mars, Earth